

CLAIMS

1. A storage system comprising:

    a plurality of data storage means including  
    therein striped data arranged in parallel;

    at least one error code storage means for  
    storing therein error check data for the data stored in  
    said plurality of data storage means;

    at least one spare storage means for storing  
    therein reconstructed data;

    monitor means for monitoring a failure in said  
    plurality of data storage means;

    comparison means for comparing, when it is  
    detected that a failure occurs in any of said plurality  
    of data storage means, before the data is reconstructed  
    on the basis of the data stored in the remaining data  
    storage means and the data stored in said error code  
    storage means, a value predetermined according to the  
    number of said error code storage means, and the number  
    of the data storage means at fault with each other; and

    reconstruct means responsive to output of said  
    comparison means for reconstructing the data based on  
    the basis of the data stored in the remaining data  
    storage means.

2. A storage system according to Claim 1, further  
comprising:

    means for discriminating, when said monitor  
    means detects a failure, the data storage means at fault

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and judging whether or not the failure had already occurred in the data storage means at fault; and

decision means for determining that when a difference in said comparison means is large, access to said plurality of data storage means is given preference, and when the difference therein is small, the data is immediately reconstructed on the basis of the data in the remaining data storage means and the data in said error code storage means.

3. A storage system according to Claim 1, further comprising:

time of day means; and

a table for storing therein a number of the data storage means of which failure is discriminated, the point of failure, and a flag representing an address of the faulty data, together with a number of the spare storage means assigned for the data reconstruction.

4. A storage system according to Claim 1, further comprising:

time of day means;

means for judging whether or not the time when the failure occurred in any of said data storage means is within a predetermined access busy time zone; and

means for determining that when the result given by said judgement means is not within the predetermined access busy time zone, only the read access to said plurality of data storage means is given preference.

5. A storage system according to Claim 1, further comprising:

time of day means; and  
means connected to said time of day means and  
said monitor means for monitoring whether or not when  
starting said plurality of data storage means, said  
error code storage means and said spare storage means, a  
starting voltage for said means is within a predeter-  
mined range.

6. A storage system according to Claim 1, further comprising:

time of day means; and  
check means connected to said time of day  
means and said monitor means for sending a pseude-  
instruction for reading out the data stored in a  
predetermined location to said plurality of data storage  
means, said error code storage means and said spare  
storage means, thereby to check responses sent  
therefrom.

7. A storage system according to Claim 1, further comprising:

time of day means; and  
check means connected to said time of day  
means and said monitor means for checking an error on  
the basis of the data which is read out from said error  
code storage means, when the data in said plurality of  
data storage means is accessed.

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8. A storage system according to Claim 1, further comprising:

time of day means; and  
means for judging whether or not a period of time from the time when a failure occurs in any of said data storage means to the present time is within a predetermined limit time zone and making, when the period of time exceeds the limit time zone, the data reconstruction take precedence over the access to said data storage means.

9. A data reconstruction system for a memory comprising:

a group of storage units for striping data into plural data of bit unit, byte unit or arbitrary unit, the plural independent storage units forming a set;

discs for storing therein ECC data corresponding to the striped data;

a spare storage unit for storing therein reconstructed data;

an I/O-reconstruction control unit for receiving a command relating to I/O issued from a host unit to execute processing according to the command or respond to said host unit;

a data reconstructing table for the storage unit at fault;

a circuit for reconstructing faulty data which performs discovery of faulty storage unit, data

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reconstruction, and write of the reconstructed data to said spare storage unit,

    said faulty data reconstructing circuit detecting, when a failure occurs in any of said storage units, the failure by an error check to inform said I/O-reconstruction control circuit of the failure occurrence, said I/O reconstruction control circuit discriminating a state of the failure; and

    judgement means for selecting preferred processing suitable for the state of the failure out of processing of access or read/write and data reconstruction processing, thereby to carry out the selected processing.

10.     A data reconstruction system for a memory according to Claim 9, wherein said I/O-reconstruction control circuit sets the frequency of the processing of access or read/write and data reconstruction, or the ratio of the processing amount, in correspondence to the state of the failure.

11.     A data reconstruction system for a memory according to Claim 9, further comprising:

    a timer for giving the point of failure, and the present time; and

    means for comparing the elapsed time during the restriction with a predetermined limit time to select the preferred processing operation.

12.     A data reconstruction method used with a memory comprising the steps of:

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performing access or read/write to or from data in parallel which is stored in storage units by striping data into the plural data of bit unit, byte unit or arbitrary unit, with the plural independent storage units as a set, and performing an error check during the access or read/write to or from the data;

detecting, when a failure occurs, the storage unit at fault by the error check, and reconstructing data stored in the storage unit at fault as long as the number of storage units at fault is within a predetermined value, while performing the processing of the normal access or read/write;

storing the reconstructed data in a spare storage unit; and

determining that either the processing of the normal access or read/write, or the data reconstruction processing is given preference in correspondence to a state of the failure.

13. A data reconstruction method used with a memory according to Claim 12, further comprising the steps of:

judging whether or not the number of storage units of which failure is not yet completed exceeds the threshold; and

changing the priority of the processing of the normal access or read/write, or the data reconstruction processing.

14. A data reconstruction method used with a memory according to Claim 12, wherein the priority of the processing of the normal access or read/write, or the data reconstruction processing is changed in accordance with the number of storage units of which failure is not yet reconstructed, and the reconstruction processing time of the storage units which broke down.
15. A data reconstruction method used with a memory according to Claim 12, wherein the priority of the processing of the normal access or read/write, or the data reconstruction processing is changed in accordance with the number of storage units of which failure is not yet reconstructed, and the time zone when the processing of the normal access or read/write is performed.
16. A data reconstruction method used with a memory according to Claim 12, wherein the priority of the processing of access or read/write, or the data reconstruction processing is changed in accordance with the number of storage units of which failure is not yet reconstructed, the accumulating totals of the reconstruction processing time of the storage units which broke down, and the frequency of the processing of access or read/write within a unit time.
17. A data reconstruction method used with a memory according to Claim 16, wherein when the frequency of the processing of access or read/write within a unit time is less than the threshold, the frequency of the

data reconstruction processing within the unit time or the ratio of the amount of data reconstruction processing is dynamically set in accordance to the frequency of the processing of access or read/write within the unit time.

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ADD B<sup>1</sup> ↗  
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